What is claimed is:

1. A method of preparing a sample chip and observing its wall surface, comprising:

a first step including irradiating a sample with a focused energy beam, etching a surrounding area and a bottom portion of a predetermined area, and making the sample chip;

a second step of taking out the sample chip from the sample; and

a third step of observing a wall surface of the taken sample chip with a scanning probe microscope (SPM).

2. The method of preparing a sample chip and observing its wall surface of claim 1, wherein said focused energy beam is a focused ion beam.

3. The method of preparing a sample chip and observing its wall surface of claim 2, wherein said first step includes processing the sample chip so that a stepped portion according to difference in material is formed in a surface to be observed with the scanning probe microscope.

4. A method of preparing a sample chip and observing its wall surface, comprising:

a first step including irradiating a sample with a focused energy beam, etching a surrounding area and a bottom portion of a predetermined area, and making the sample chip;

a second step of taking out the sample chip from the sample;

a third step of observing a wall surface of the taken sample chip with a scanning probe microscope ;

a fourth step of irradiating the SPM-observed surface of the taken sample chip with the focused energy beam thereby to etch the SPM-observed surface; and

a step of repeating said third and fourth steps only a required number of times again.

5. The method of preparing a sample chip and observing its wall surface of claim 4, wherein said focused energy beam is a focused ion beam.

6. The method of preparing a sample chip and observing its wall surface of claim 5, wherein said first step includes processing the sample chip so that a stepped portion according to difference in material is formed in a face to be observed with the scanning probe microscope.

7. A method of preparing a sample chip and observing its wall surface, comprising:

a first step including irradiating a sample with a first focused energy beam, etching a surrounding area and a bottom portion of a predetermined area, and making the sample chip;

a second step of taking out the sample chip from the sample;

a third step of irradiating a specified wall surface, which the SPM-observed surface of the taken sample chip makes, with a second focused energy beam thereby to etch the wall

surface; and

a fourth step of observing the wall surface of the sample chip, which has undergone the etching by the second focused energy beam in said third step.

8. The method of preparing a sample chip and observing its wall surface of claim 7, wherein said first focused energy beam is a focused ion beam, and

said second focused energy beam is an argon ion beam.

9. The method of preparing a sample chip and observing its wall surface of claim 8, wherein said first step includes processing the sample chip so that a stepped portion according to difference in material is formed in a face to be observed with the scanning probe microscope.

10. A method of preparing a sample chip and observing its wall surface, comprising:

a first step including irradiating a sample with a first focused energy beam, etching a surrounding area and a bottom portion of a predetermined area, and making the sample chip;

a second step of taking out the sample chip from the sample;

a third step of irradiating a specified wall surface, which the SPM-observed surface of the taken sample chip makes, with a second focused energy beam thereby to etch the wall surface;

a fourth step of observing the wall surface of the sample

chip, which has undergone the etching by the second focused energy beam in said third step;

a fifth step of irradiating the SPM-observed surface of the taken sample chip with the first focused energy beam thereby to etch the SPM-observed surface; and

a step of repeating said third to fifth steps only a required number of times again.

11. The method of preparing a sample chip and observing its wall surface of claim 10, wherein said first focused energy beam is a focused ion beam, and

said second focused energy beam is an argon ion beam.

12. The method of preparing a sample chip and observing its wall surface of claim 11, wherein said first step and/or fifth step include processing the sample chip so that a stepped portion according to difference in material is formed in a face to be observed with the scanning probe microscope.

13. A method of preparing a sample chip and observing its wall surface, comprising:

a first step including irradiating a sample with a first focused energy beam, etching a surrounding area and a bottom portion of a predetermined area, and making the sample chip;

a second step of taking out the sample chip from the sample;

a third step of irradiating a specified wall surface, which the SPM-observed surface of the taken sample chip makes,

with a second focused energy beam thereby to etch the wall surface;

a fourth step of observing the wall surface of the sample chip, which has undergone the etching by the second focused energy beam in said third step;

a fifth step of irradiating the SPM-observed surface of the taken sample chip with the second focused energy beam thereby to etch the SPM-observed surface; and

a step of repeating said fourth and fifth steps only a required number of times again.

14. The method of preparing a sample chip and observing its wall surface of claim 13, wherein said first focused energy beam is a focused ion beam, and

said second focused energy beam is an argon ion beam.

15. The method of preparing a sample chip and observing its wall surface of claim 14, wherein said first step includes processing the sample chip so that a stepped portion according to difference in material is formed in a observed surface to be observed with the scanning probe microscope.

16. The method of preparing a sample chip and observing its wall surface of claim 1, wherein the sample chip to be cut off is shaped into an asymmetric form thereby to allow the observed surface of the sample chip for observation with the scanning probe microscope to be identified.

17. A system for preparing a sample chip and observing

a wall surface of the sample chip, comprising:

a focused ion beam apparatus for cutting off the sample chip from a sample by etching;

a pick-up apparatus for taking up the sample chip cut away from the sample;

a sample chip holder for securing the sample chip taken up by said pick-up apparatus with an SPM-observed surface upward; and

a scanning probe microscope for observing the observed surface of the sample chip secured to said sample chip holder, and

said sample chip holder mountable in a focused ion beam irradiated position of said focused ion beam apparatus.

18. The system for preparing a sample chip and observing a wall surface of the sample chip of claim 17, wherein said scanning probe microscope includes:

a sample stage at least movable in a three-dimensional space at least for setting thereon said sample chip holder for securing the sample chip;

an argon ion beam irradiating apparatus for irradiating a surface of the sample chip with an argon ion beam substantially from a tangent direction of the sample chip surface to etch the surface in a condition where said sample stage has been moved away from said scanning probe microscope unit;

said scanning probe microscope for observing the surface of the sample chip;

a vacuum chamber for maintaining said sample stage, argon ion beam irradiating apparatus and scanning probe microscope under vacuum; and

a vacuum pump system for evacuating said vacuum chamber.

19. The system for preparing a sample chip and observing a wall surface of the sample chip of claim 17, wherein said scanning probe microscope is capable of measuring properties of the sample chip by detecting various physical quantities involved in interactions caused between a probe of said scanning probe microscope and the sample chip.

20. The system for preparing a sample chip and observing a wall surface of the sample chip of claim 19, wherein said physical quantities are physical quantities in connection with electrical properties of the sample including sample's electrical conductivity, dopant concentration, dielectric constant, electric potential, leaking magnetic field, and spin interaction.

21. The system for preparing a sample chip and observing a wall surface of the sample chip of claim 19, wherein said physical quantities are physical quantities in connection with mechanical properties of the sample including sample's hardness, friction, and elasticoviscosity.

22. The system for preparing a sample chip and observing

a wall surface of the sample chip of claim 17, further comprising a cutting unit for cutting a sample surface with a diamond needle for a purpose of additionally processing the sample chip.

23. The system for preparing a sample chip and observing a wall surface of the sample chip of claim 17, wherein a voltage is applied to the sample chip to perform anodization thereby to form an insulating layer on a surface of the sample chip for a purpose of additionally processing the sample chip.

24. A system for preparing a sample chip and observing a wall surface of the sample chip, comprising:

a focused ion beam apparatus for cutting off the sample chip from a sample by etching;

a pick-up apparatus for taking up the sample chip cut away from the sample;

a sample chip holder for securing the sample chip taken up by said pick-up apparatus with an SPM-observed surface upward;

an argon ion beam irradiating apparatus for irradiating a observed surface of the sample chip with an argon ion beam substantially from a tangent direction of the observed surface of the sample chip secured to said sample chip holder; and

a scanning probe microscope for observing the observed surface of the sample chip secured to said sample chip holder, and

said sample chip holder mountable in a focused ion beam irradiated position of said focused ion beam apparatus.

25. The system for preparing a sample chip and observing a wall surface of the sample chip of claim 17,

wherein said sample chip holder has a space for securing the sample chip located in its end face, and

said space for securing the sample chip has a shape and a size, both discernible for an operator with the eye.

26. The system for preparing a sample chip and observing a wall surface of the sample chip of claim 17,

wherein said sample chip holder has a surface coated with a conducting metal and has capabilities of causing a current to flow through the sample chip and grounding the sample chip.

27. The system for preparing a sample chip and observing a wall surface of the sample chip of claim 17,

wherein said sample chip holder has a low-melting-point metal, such as indium, on a surface thereof, and has a mechanism such that said sample chip holder and the sample chip are heated to melt the low-melting-point metal thereby to secure the sample chip and establish good conductivity between the sample chip and said sample chip holder.

28. The system for preparing a sample chip and observing a wall surface of the sample chip of claim 17,

wherein said sample chip holder has a low-melting-point

polymer on a surface thereof and has a mechanism such that said sample chip holder and the sample chip is heated to melt the low-melting-point polymer thereby to secure the sample chip and isolate the sample chip from said sample chip holder.

29. The system for preparing a sample chip and observing a wall surface of the sample chip of claim 17,

wherein said sample chip holder has a flat insulator substrate, such as Macor(R), with a plurality of electrodes thereon, and

said sample chip holder permits wiring between the electrodes thereof and electrodes of the sample chip by wire bonding, etc.

30. A pick-up apparatus comprising:

a sample stage movable at least in a three-dimensional space, on which a sample can be put;

tweezers for pinching and picking up a sample chip put on said sample stage by remote control operation;

a manipulator capable of controlling a position of said tweezers in three dimensions; and

a microscope which enables observation of positions of said tweezers and the sample chip.

31. The pick-up apparatus of claim 30, wherein said manipulator includes: a first actuating shaft for shifting a position of said tweezers in a horizontal direction; a second actuating shaft for shifting the position in a vertical

direction; and a third actuating shaft for shifting the position in a normal line direction of a plane formed by said first and second actuating shafts; and fourth actuating shaft for rotating the position around said third actuating shaft.

32. The pick-up apparatus of claim 30, wherein said microscope is an optical microscope.

33. The pick-up apparatus of claim 30, wherein said microscope is a scanning electron microscope, and

the apparatus further comprises a vacuum chamber for maintaining said constituent elements in vacuum.

34. The pick-up apparatus of claim 30, wherein said microscope is a scanning ion microscope, and

the apparatus further comprises a vacuum chamber for maintaining said constituent elements in vacuum.

35. A scanning probe microscope, comprising:

a sample stage at least movable in a three-dimensional space for setting thereon a sample chip holder for securing a sample chip;

an argon ion beam irradiating apparatus for irradiating a surface of the sample chip with an argon ion beam substantially from a tangent direction of the sample chip surface to etch the surface in a condition where said sample stage has been moved away from a scanning probe microscope unit;

said scanning probe microscope unit for observing the surface of the sample chip;

a vacuum chamber for maintaining said sample stage, argon ion beam irradiating apparatus and scanning probe microscope under vacuum; and

a vacuum pump system for evacuating said vacuum chamber.